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THE SANITATION AND BACTERIOLOGY OF PUBLIC EATING UTENSILS [1]

AN INVESTIGATION OF PUBLIC EATING AND DRINKING ESTABLISHMENTS IN PROVIDENCE, R. I.

By MURRAY P. HORWOOD, Ph. D., *Department of Biology and Public Health, Massachusetts Institute of Technology*, and P. J. PESARE, C. P. H., *Bacteriologist, Rhode Island State Department of Health*

The urbanization of the population together with the tremendous increase in travel by motorcar, by plane, by ship, and by rail, have resulted in a marked increase in public eating and drinking establishments and in the practice of eating away from home. Commensurately, the kitchen and dining room in the individual home have diminished in sanitary significance as the use of public facilities has increased. Today "food and drink come from many sources; they are manipulated by many hands; and they are dispensed to many patrons." Homer N. Calver estimates that the number of people in the United States served in public eating and drinking establishments would be approximately the equivalent of one service, a meal or a drink, per person per day.

The magnitude of the problem is also indicated by the data issued by the United States Bureau of the Census in 1937 in the Census of Business, 1935. These data indicate that there are approximately 300,000 eating and drinking establishments in the United States and that the money value of the sales made at these places amounts to about $2,500,000,000 per year.

TABLE 1.—*Number of independent eating and drinking establishments in Rhode Island and in the United States in 1935 and their sales*

Type of establishment	Total number		Sales	
	United States	Rhode Island	United States	Rhode Island
Restaurants, cafeterias, and lunchrooms	110, 299	520	$1, 239, 790, 000	$6, 848, 000
Lunch counters and refreshment stands	39, 246	146	185, 323, 000	783, 000
Drinking places	97, 929	720	723, 554, 000	5, 924, 000
Drug stores (having soda fountains)	35, 673	300	(1)	(1)
Total	283, 147	1, 686	2, 148, 667, 000	13, 555, 000

[1] Data not available.

[1] Read at joint session of Engineering and Food and Nutrition Sections of the American Public Health Association at Atlantic City, October 15, 1941. (Contribution No. 195 of the Department of Biology and Public Health, Massachusetts Institute of Technology.)

The danger of the common drinking cup was recognized many years ago and its use has been prohibited by public health authorities. The public eating and drinking establishments present, however, far more opportunities for the transmission of infection; and their satisfactory sanitary control represents not only a public health problem of the first magnitude but a problem of public decency as well. Not only are cups and glasses used in common by many people but so are the spoons, knives, forks, and plates. The public health problem is further augmented by the wide variety of foods and drinks which are served. These must be fresh and wholesome to begin with; they must be prepared and handled by individuals free of disease at all times; they must be thoroughly refrigerated before and after preparation; and they must be protected at all times against flies and other insects, against rodents, and against dusts and dirt.

While there is ample evidence of the relationship of infected food, milk, and water to the dissemination of disease, it is more difficult to prove the relationship between methods of dishwashing and the spread of disease in the community.[2] Yet the most glaring sanitary defect observed during the careful inspection of two large military camps in July 1941 was the lack of adequate and satisfactory dishwashing facilities. A visit to numerous restaurants and lunchrooms, especially during the rush periods of the day, will invariably bring conclusive evidence of the seriousness of this outstanding sanitary defect in public eating and drinking establishments. The public health importance of this condition increases materially during epidemics of respiratory disease. For decency as well as for adequate public health protection satisfactory cleansing and sterilization of all eating and drinking utensils in public places should be required and rigidly enforced.

SCOPE OF THE PRESENT INVESTIGATION

Because of the significant relation believed to exist between the sanitation of public eating and drinking places and the public health and because a careful survey of such places in Providence, including the use of a standard score card and laboratory examinations of eating utensils, had never been made, this study was undertaken. The score card employed was a modification of the inspection form used by the New York City Department of Health. In the investigation of methods of dishwashing, information was obtained concerning the facilities available; the temperature of the wash water and rinse water; the time of exposure of the dishes and eating utensils to the germicidal action of hot water or the chemical disinfectant employed; the iden-

[2] A review of the literature and the bibliography employed in the preparation of this paper are omitted here for the sake of brevity.

tity of the detergent and disinfectant used; and the method employed in drying and storing cleaned eating utensils.

The laboratory investigation included the determination on eating and drinking utensils of total counts on rabbit blood agar at 37° C. after 48 hours; and the examination of such specimens for specific bacteria, such as *E. coli*, *A. aerogenes*, acid-fast organisms, the organisms of Vincent's infection, hemolytic streptococci, hemolytic staphylococci, and *Corynebacterium diphtheriae*. Controlled laboratory experiments were also conducted in order to determine the essential requirements for the effective chemical sterilization of beverage glasses with chlorine compounds under conditions similar to those obtaining in practice. This phase of the work, however, is not reported here.

In all, 55 public eating and drinking establishments widely distributed throughout Providence were examined in order to obtain a representative sampling of the public eating and drinking establishments in the city. The places examined included 18 restaurants, 8 soda fountain dispensaries, 10 cafes, and 19 barrooms. The investigation was conducted during the summer of 1939 and the lack of positive findings for the presence of respiratory organisms on the eating and drinking utensils may be due to the absence of respiratory disease in epidemic form in the community at that time. Visits were made to the eating and drinking establishments during or immediately after the noon rush period, i. e., from 11:30 a. m. to 2:30 p. m. While proprietors and managers complained about this procedure, it was considered desirable for the purpose of this study to obtain information when the conditions were of maximum public health significance.

Each establishment was visited twice, the two visits being made within 3 to 5 days of each other and without previous warning or notification. The first visit was utilized mainly to obtain the information called for on the score card (see table 2). The occasion was also utilized as an opportunity to educate the manager and employees in the essentials of good sanitation and personal hygiene. The abysmal ignorance of many lay people of the simple requirements of acceptable sanitary practices and good personal hygiene is convincing evidence of the importance of educational procedures in public health engineering activities. Certainly we shall not make suitable progress in correcting the numerous sanitary deficiencies found in public eating and drinking establishments until the personnel involved are enlightened and until their intelligent cooperation is obtained.

The second visit was confined mainly to a detailed study of the dishwashing facilities available and to the methods employed. When chlorine disinfection was employed, the concentration of available chlorine in the rinse water was checked by means of the orthotolidin

test. All necessary samples for the bacteriological examination of dishes, eating utensils, and rinse water were also obtained at this time. The samples were obtained by the multi-swab method recommended by the American Public Health Association.

EXAMINATION OF CULTURES

Examination of blood agar pour plates for hemolytic colonies.—This examination was made at the end of 18 and 48 hours. All hemolytic colonies were picked. Film preparations of the picked colonies were stained by Gram's method.

Those colonies which were suspected of being hemolytic streptococci, as indicated by the microscopic examination and the macroscopic appearance of the colony, were subcultured in 10 ml. of dextrose broth and observed for the characteristic chain formation of Gram-positive streptococci.

Colonies of hemolytic staphylococci were identified directly from the microscopic examination and the macroscopic appearance of the colonies.

Examination of growth on Loeffler's blood serum for the presence of Corynebacterium diphtheriae.—After 24 hours' incubation, a general smear of the growth on the blood serum slant was prepared and stained with Albert's stain. This stained film was examined for the presence of diphtheria bacilli.

Examination of lactose broth cultures.—Those fermentation tubes showing the presence of gas after 24 hours' incubation were recorded as positive presumptive tests for coliform organisms. Those tubes which showed no gas formation were reincubated for another 24 hours. Any tubes showing gas after 48 hours were recorded as doubtful presumptive tests.

The positive and doubtful presumptive tests were confirmed on eosin-methylene-blue agar plates (Bacto-dehydrated Levine's Formula).

Typical *E. coli* colonies appearing on the eosin-methylene-blue agar plates were transferred to agar slants and to lactose broth fermentation tubes. After 24 hours' incubation at 37° C. the lactose broth tubes were observed for gas formation and a film preparation of the agar-slant growth stained by Gram's method was examined for the presence of Gram-negative, non-spore-forming rods typical of *E. coli*.

Those colonies which appeared to be typical of the Aerobacters were transferred to tubes of nutrient broth and incubated at 37° C. for 18 hours, at which time motility tests were performed, to distinguish between the usually nonmotile *Aerobacter aerogenes* and the motile *Bacterium cloacae*.

Total bacterial counts after 48 hours' incubation.—After 48 hours' incubation at 37° C. the blood-agar pour plates were counted with the aid of a Quebec colony counter.

RESULTS OF SANITARY INSPECTIONS

Table 2 records the items scored in the sanitary survey of the public eating and drinking establishments included in this study, together with an analysis of the findings for each type of establishment.

TABLE 2.—*Number and percentage of establishments fulfilling the specified sanitary requirements*

Items scored	Soda fountains		Restaurants		Cafes		Barrooms		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
1. Walls, ceilings, and floors:										
a. Good repair	7	88.8	16	88.8	8	80.0	14	73.6	45	81.8
b. Clean	7	88.8	14	77.7	6	60.0	4	21.0	31	56.3
c. Oil paint or nonscaling water paint	8	100.0	18	100.0	8	80.0	17	89.4	51	92.7
2. Showcases, windows, and counters:										
a. Clean and in good repair	7	88.8	16	88.8	10	100.0	19	100.0	52	94.5
3. Screens:										
a. Windows, doors, and other openings adequately screened (April–October)	2	25.0	9	50.0	8	80.0	12	63.0	31	56.3
b. Screen doors are self-closing	2	25.0	9	50.0	9	90.0	12	63.0	32	58.1
c. Excessive numbers of flies absent	3	37.5	7	38.8	5	50.0	4	21.0	19	34.5
4. Toilets:										
a. Provided and properly enclosed	7	88.8	17	94.4	10	100.0	17	89.4	51	92.7
b. Conveniently located	5	62.0	10	55.5	10	100.0	18	94.7	43	78.1
c. Clean and in good repair	5	62.0	8	44.4	4	40.0	5	26.3	22	40.0
d. Adequately ventilated and lighted	4	50.0	7	38.8	6	60.0	6	31.5	23	41.8
e. Notice directing employees to wash their hands after use of toilet	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
f. Self-closing door	4	50.0	7	38.8	6	60.0	6	31.5	23	41.8
5. Garbage and refuse:										
a. Water-tight metal containers	8	100.0	16	88.8	6	60.0	(1)	(1)	30	83.3
b. Refuse adequately stored and disposed of	7	88.8	12	66.6	7	70.0	(1)	(1)	26	72.2
6. Storage of foods:										
a. Proper receptacles	5	62.0	10	55.5	4	40.0	(1)	(1)	19	52.7
b. At least 2 feet above the floor	5	62.0	4	22.2	2	20.0	(1)	(1)	11	30.5
c. Protected against rodents and excreta	4	50.0	5	27.7	2	20.0	(1)	(1)	11	30.5
d. Protected against dust	6	75.0	7	38.8	3	30.0	(1)	(1)	16	44.4
e. Protected against insects	6	75.0	7	38.8	3	30.0	(1)	(1)	16	44.4
7. Kitchen, dining room, and storeroom:										
a. Adequately lighted	8	100.0	16	88.8	6	60.0	(1)	(1)	30	83.3
b. Adequately ventilated	8	100.0	16	88.8	7	70.0	(1)	(1)	31	86.1
c. Free from rubbish and dirt	6	75.0	11	61.1	7	70.0	(1)	(1)	24	66.6
8. Perishable foods and refrigeration:										
a. Perishable foods stored at 50° F. or below	6	75.0	17	94.4	7	70.0	(1)	(1)	30	83.3
b. Refrigerator is clean and in good repair	7	88.0	16	88.8	7	70.0	(1)	(1)	30	83.3
c. Ice-box drains into a removable pan	8	100.0	17	94.4	10	100.0	(1)	(1)	35	97.7
d. Conveniently located	8	100.0	17	94.4	10	100.0	(1)	(1)	35	97.7
9. Lockers for employees' clothing:										
a. Clean and well ventilated	4	50.0	6	33.3	2	20.0	(1)	(1)	12	33.0
b. Separated from food preparation	5	62.0	8	44.4	3	30.0	(1)	(1)	16	44.4
10. Employees:										
a. Health cards available	8	100.0	18	100.0	8	80.0	11	57.8	45	81.8
b. Clean, washable outer garments	8	100.0	14	77.7	6	60.0	16	84.2	44	80.0
c. Clean and neat in appearance	8	100.0	15	83.3	8	80.0	14	73.6	45	81.8
11. Washing facilities:										
a. Adequate and conveniently located	7	88.0	11	61.1	9	90.0	13	68.0	40	72.7
b. Clean and in good repair	7	88.0	11	61.1	8	80.0	11	62.0	37	67.1
c. Clean towel, soap, and running hot water	6	75.0	8	44.4	6	60.0	3	15.7	23	41.8
12. Miscellaneous:										
a. Running hot and cold water	8	100.0	17	94.4	9	90.0	12	63.0	46	83.6
b. Safe and adequate plumbing	8	100.0	18	100.0	10	100.0	19	100.0	55	100.0
c. Apparatus and utensils are clean	7	88.0	10	55.5	8	80.0	12	63.0	37	67.1
d. Ventilating hoods in kitchen	6	75.0	18	100.0	7	70.0	(1)	(1)	31	56.1

[1] Not required.

The following sanitary defects occurred relatively frequently. Unclean walls, ceilings, and floors were common. The windows, doors, and other openings were inadequately screened. The screen doors were not always self-closing. Flies were often observed in excessive numbers. Toilets were often unclean or in poor repair; they were inadequately lighted and ventilated, and were not provided with self-closing doors. In no case was a notice posted requesting employees to wash their hands after using the toilet. The storage of food was unsatisfactory.

TABLE 3.—*Total bacterial counts from public eating utensils after 48 hours on rabbit blood agar at 37° C.*

Source	Minimum	Maximum	Mean	Median
18 Restaurants:				
Plates	500	1,000,000	300,000	7,500
Tumblers	500	76,000,000	200,000	45,000
Spoons	10	48,000	5,400	1,200
Forks	80	48,000	6,300	9,000
8 Soda fountains:				
Plates	300	200,000	37,000	20,000
Tumblers	50	1,300,000	390,000	72,000
Spoons	800	9,000	2,800	1,600
Forks	200	20,000	4,000	1,300
10 Cafes:				
Plates	800	200,000	58,000	29,000
Tumblers	4,800	1,000,000	80,000	60,000
Spoons	50	60,000	13,000	1,200
Forks	50	52,000	7,000	1,000
10 Cafe bars:				
Beer glasses	10,000	1,200,000	385,000	211,000
Rinse water	1,800	900,000	330,000	132,000
19 Barrooms:				
Beer glasses	6,000	70,000,000	7,000,000	13,000,000
Rinse water	8,000	54,000,000	13,000,000	1,900,000

TABLE 4.—*Types of bacteria isolated from eating and drinking utensils and rinse water together with the number and percentage of samples showing the presence of each type*

	Plates	Tumblers	Spoons	Forks	Rinse water	Beer glasses	Number of examinations	Number positive	Percent positive
Escherichia coli	0	1	0	0	1	1	184	3	1.6
Aerobacter aerogenes	15	21	5	0	26	10	184	77	41.8
Acid-fast organisms	1	1	1	1	1	1	184	6	3.2
Organisms of Vincent's angina	0	0	0	0	0	0	184	0	0.0
Hemolytic streptococci	1	0	1	0	0	0	184	2	1.1
Hemolytic staphylococci	2	5	1	2	0	0	184	10	5.4
Corynebacterium diphtheriae	0	0	0	0	0	0	184	0	0.0

Predominating organisms: 1. *B. subtilis;* 2. *Staphylococcus albus.*

Table 4 records the frequency with which each type of organism for which tests were made was isolated from the eating and drinking utensils and from the rinse water.

Completed tests for *E. coli* were obtained in only 3 instances, or in 1.6 percent of the samples examined. Contamination with *A. aerogenes,* however, occurred very frequently, the organism being

recovered in 41.8 percent of the samples. This may reflect the fact that the organism can be isolated frequently from foods, especially cereal foods. Its presence on washed eating and drinking utensils indicates unsatisfactory dishwashing. *A. aerogenes* may well be considered a suitable index of the quality of dishwashing, just as *E. coli* is regarded as the sanitary index for drinking water. Differential tests made on *aerogenes*-like cultures on E. M. B. agar plates to determine the frequency of *B. cloacae* were all negative.

While acid-fast organisms were recovered in 6 instances, or 3.2 percent of the samples examined, and were obtained from the eating and drinking utensils and rinse waters of 2 of the 55 establishments, guinea pig inoculations for *Mycobacterium tuberculosis* were all negative. The centrifugates showing the presence of acid-fast bacilli were digested with 1–N sodium hydroxide at 37° C. for 20 minutes and then neutralized with 1–N hydrochloric acid. One ml. of each neutralized specimen was then injected subcutaneously into guinea pigs. At the end of 6 weeks the animals were anaesthetized and examined for the presence of typical tuberculous lesions in the inguinal lymph nodes and in the spleen. The results were negative. Histological sections of the spleen also showed no signs of tuberculous pathology. These negative findings, however, should not be interpreted to mean that the danger of tuberculous infection by this route is absent.

Efforts made to recover the spirochete of Vincent's angina from washed public eating and drinking utensils in Providence during the summer months were also negative. Similarly, hemolytic streptococci were isolated only in 2 of the 184 samples examined, or in 1.1 percent of the cases. The colonies on blood agar were small and of the pin-point variety and showed a narrow zone of hemolysis. Subcultured in dextrose broth, they were found to be Gram-positive and to occur in chains having from 6 to 10 cells.

It is possible, perhaps even probable, that if this investigation had been conducted during the winter months, the positive findings of hemolytic streptococci on public eating and drinking utensils would have been very much higher. In 1917, Cumming was able to isolate hemolytic streptococci in 91.1 percent of the specimens examined from 23 sets of tableware. On the other hand, Saelhof and Heinekamp in 1920 isolated hemolytic streptococci from 4 out of 63 eating and drinking utensils examined, a frequency of 6.35 percent. They showed, however, that these hemolytic streptococci were virulent for rabbits and that they corresponded to the human strain.

Hemolytic staphylococci were isolated in 10 of the 184 samples examined, a frequency of 5.4 percent. The organisms were uniformly identified as *Staphylococcus aureus*. In 1920, Saelhof and Heine-

kamp recovered similar organisms in 3.2 percent of the 63 utensils examined, while in 1931, Kuposky isolated hemolytic *Staphylococcus aureus* in 12.7 percent of the 118 samples examined. Since this organism is of public health significance, the frequency with which it can be isolated from public eating and drinking utensils is important.

None of the 184 samples examined for *Corynebacterium diphtheriae* were positive. This may have been due to the seasonal handicap of this investigation and also to the diminishing incidence of diphtheria. From 1912–1921, there was an average annual incidence in Rhode Island of 1,300 cases and 119 deaths from diphtheria. In 1937, however, only 38 cases and 3 deaths from diphtheria were reported. In 1917, Cumming examined 26 sets of tableware for diphtheria bacilli and recovered the organism in 2 percent of the samples. It must also be remembered that diphtheria is a disease of children primarily, who do not frequent public eating and drinking establishments as do adults.

The predominating organisms found on the eating and drinking utensils examined were the hardy organisms, *Bacillus subtilis* (a spore former) and *Staphylococcus albus*. These organisms, which are found in soil and dusts, were probably derived from such sources.

TEMPERATURES OF WASH WATER AND RINSE WATER

Since the temperature of the wash water and the rinse water plays an important role in determining the amount of bacterial pollution left on eating and drinking utensils, this aspect of the subject was included in the investigation. The results observed are recorded in table 5.

TABLE 5.—*Temperatures in degrees F. of wash water and rinse water used for eating utensils in various public eating places*

Source	Minimum	Maximum	Mean	Median	Mode
18 Restaurants:					
Wash water	70	[1] 180	114	110	100–109
Rinse water	66	[1] 180	135	145	140–149
8 Soda fountains:					
Wash water	120	[2] 212	134	130	120–129
Rinse water	59	[2] 171	94	59	50– 59
10 Cafes:					
Wash water	78	[2] 120	92	100	100–109
Rinse water	55	[2] 155	106	134	140–149
10 Cafe bars:					
Wash water	68	[2] 112	78	74	60–79
Rinse water	55	[2] 68	61	61	50–69
19 Barrooms:					
Wash water	59	[2] 94	70	68	60–69
Rinse water	55	[2] 68	62	64	60–69

[1] Machine washed.
[2] Hand washed.

It is seen from the data recorded in table 5 that even in a modern American city with an excellent record for public health administration and achievement, the sanitation of eating and drinking utensils

in public establishments is far from satisfactory. Most of the dishwashing is still done by hand and the temperatures of the wash water and the rinse water are invariably woefully inadequate either for thorough cleansing or for sterilization. While higher temperatures normally prevail in mechanical dishwashers, this condition is not guaranteed. Where hand washing is employed the wash water is rarely hotter than lukewarm. It is unquestionably more difficult to cleanse soiled dishes and eating utensils with lukewarm water than with hot water. In providing sanitary dishes and eating utensils it is important to concentrate on thorough preliminary cleansing and washing. The final rinse should simply provide insurance of a sanitary utensil. The situation is analagous to the production of clean, wholesome milk to begin with, and then safeguarding its bacterial quality by pasteurization.

The time of exposure of dishes and eating utensils to the germicidal action of hot water or chemical disinfectants varied from 2 to 5 seconds to a period as long as 5 minutes. The average holding time employed in restaurants was 120 seconds; at soda fountains, 55 seconds; at restaurant cafes, 180 seconds; at cafe bars, 10 to 17 seconds; and in barrooms, 6 to 12 seconds.

Providing sanitary dishes and eating utensils in public establishments is not dependent on the temperature of the wash water and rinse water alone. Many other factors enter into the picture, such as the amount and character of the soil, the amount and character of the detergent employed, the thoroughness and duration of the washing and rinsing, the use of dishtowels and their cleanliness, and the conditions under which the dishes and utensils are stored prior to use. However, it is important to remember that cooked dirt is usually harmless, whereas uncooked dirt is not.

The washing of glasses presents a particularly important public health problem, for the unclean, nonsterile glass provides an excellent opportunity for traffic in human saliva and hence for the transmission of infection. In this investigation the beer glasses found in cafes were cleaner and contained fewer bacteria than the beer glasses found in barrooms. In neither case, however, were the glasses considered to be clean and sanitary. Washing and rinsing were performed in cold water. Reliance was placed on a "magic powder" introduced in uncertain and probably inadequate amounts into the wash water from one to three times a day. The chemical composition of the "magic powder" is unknown and is not ascertainable from the label on the original container. Chlorine compounds were used to disinfect beer glasses in only two instances, but the germicidal agent was not used intelligently and tests disclosed the presence of only 10 parts per million of available chlorine. Where chemical disinfection is employed, the glasses should first be thoroughly washed in water

containing a suitable amount of effective detergent at 120° F. After that the glasses should be rinsed in clean, running tap water and then immersed for 2 minutes, or longer, in a solution containing at least 50 parts per million of available chlorine. When freshly prepared, the chlorine solution should contain 100 parts per million of available chlorine and at no time should the chlorine content be allowed to fall below 50 parts per million. The temperature should be maintained between 60° and 80° F. Where chloramine is employed, the concentration used should yield the same germicidal efficiency as the chlorine solutions described. After the glasses have been washed and disinfected in this manner they should be allowed to drain on a suitable drain-shelf which permits the drainage to be removed. Rinsing in cold, running tap water may be left to the discretion of the operator.

Where mechanical or manual washing of dishes and eating utensils is employed the soil should preferably be removed first with the aid of running water at 120° F. This may be facilitated by the use of a clean dish-mop or brush. The utensils should then be washed at 120° F. in clean water containing an adequate amount of a suitable detergent at all times. After that the utensils should be rinsed for at least 2 minutes in clean water at a temperature not less than 170° F. The utensils should then be allowed to drain and dry, preferably without wiping, and then stored where they will be free of contamination from dust, dirt, insects, rodents, and humans. Glasses should be treated the same way. It is usually necessary, however, to wipe the glasses with a clean, linen towel while they are hot. Single service paper containers of suitable quality which have been effectively protected against contamination may be substituted for the glasses, dishes, and eating utensils wherever possible. Such containers after use, like other utensils, should be freed of organic matter by rinsing in running water and stored in a satisfactory manner until collected or destroyed.

CONCLUSIONS

1. A thorough sanitary survey of public eating places coupled with the bacteriological examination of dishes and eating utensils may serve as an excellent basis on which to formulate an effective campaign of education leading to improvement in the sanitation of public eating establishments.

2. Ignorance of accepted sanitary requirements and procedures as manifested by the managers and employees of public eating and drinking establishments appeared to be the most important single cause of insanitary practices in such places. It seems evident that the public health engineering profession is not utilizing education adequately as a tool to improve sanitary conditions and practices in public eating and drinking establishments.

3. The health card required of all employees in public eating and drinking establishments, as now issued, has degenerated into a mere formality and as such is of no practical significance. This requirement should, therefore, be repealed.

4. There is no correlation between high temperature of rinse water and low bacterial counts of utensils ready for use since a temperature of 170° F. or more is only one of many factors which influence the bacterial counts. Other important factors are (*a*) the length of time the utensils are exposed to the hot water; (*b*) the composition and amount of detergent; (*c*) the thoroughness of preliminary washing and removal of the soil; (*d*) the method of drying the washed utensils; (*e*) the method of handling and storing washed utensils and their protection against dust, dirt, insects, rodents, and human contamination.

5. The temperatures of the wash waters and rinse waters observed were universally too low to insure the effective disinfection of eating and drinking utensils.

6. The period of exposure of eating and drinking utensils to the germicidal action of hot water or of chemical disinfectants was extremely variable and in most instances far too short to insure effective disinfection.

7. The swab-multiple-utensil method of examination is a practical and reasonably effective means of determining the bacteriological condition of eating and drinking utensils.

8. The total count is a satisfactory index of the sanitary efficiency of the methods employed in washing, disinfecting, handling, and storing eating and drinking utensils.

9. There is no correlation between high total counts and the presence of specific pathogenic organisms.

10. Concerning the specific types of bacteria found on eating and drinking utensils this study showed that:

(*a*) *E. coli* may be carried by such utensils.

(*b*) *A. aerogenes* may be isolated frequently.

(*c*) Few, if any, of the organisms associated with Vincent's angina are able to resist the customary dishwashing and glasswashing procedures when the infection is not prevalent in epidemic form.

(*d*) Hemolytic streptococci and staphylococci can be readily recovered from public eating and drinking utensils.

(*e*) Under present conditions of diphtheria incidence, the diphtheria bacillus is not readily isolated from public eating and drinking utensils.

(*f*) Acid-fast bacteria, not identified as *Mycobacterium tuberculosis*, can be and are carried by public eating and drinking utensils.

(*g*) *B. subtilis* and *Staphylococcus albus* were found to be the most frequent contaminants of public eating and drinking utensils.

11. A concentration of 50 parts per million of available chlorine acting for 15 seconds was found to be sufficient to effect a reduction of 99.9 percent in the bacterial counts of beverage glasses artificially contaminated with *Staphylococcus aureus* and *Aerobacter aerogenes* when the glasses are freed of organic matter before immersion in the chlorine rinse solution at a temperature of 59° F. The pH of the tap water used to prepare the chlorine rinse solution was 9.3.

12. Ninety percent of the bartenders do not employ the heat-treatment method of disinfecting beverage glasses. Most of them depend on the magic effects of some soap powder of unknown chemical composition acting only for a period varying from 6 to 12 seconds.

13. The use of chlorine compounds for the disinfection of beverage glasses under controlled conditions and in a satisfactory manner can be made a practical and effective method of providing clean and relatively sterile glasses in public drinking places. However, most of the establishments using chlorine disinfection at present are guilty of gross misuse of this procedure.

14. The single service paper container or utensil of good quality, which is also protected against human, animal, insect, and atmospheric contamination, as required of all utensils and containers, can be employed as a sanitary substitute for glasses, cups, and other utensils that are not clean or safe. After use, paper containers should be rinsed free of all organic matter, wherever possible, and then stored properly until collected and destroyed. Where paper containers or utensils are destroyed promptly by incineration, rinsing to remove organic matter may be unnecessary. No paper container or utensil used for food or drink should be used more than once.

ANTITULAREMIC SERUM [1]

By Edward Francis, *Medical Director (Retired), and* Lloyd D. Felton, *Senior Surgeon, United States Public Health Service*

Foshay's advocacy in numerous articles [2] of antitularemic serum for the treatment of tularemia in man has prompted the renewal of our search for specific protective bodies in antitularemic serum. The presence of high titer protective antibody in immune serum is essential for satisfactory action against pneumococcus and meningococcus infections. As far as known, protective antibody is the only agent which brings about curative action following passive transfer of any immune serum. Thus it would seem logical in the case of *Bacterium tularense* to establish whether or not a protective serum could be developed as measured in experimental animals. In other words,

[1] From the Division of Infectious Diseases, National Institute of Health.

[2] See especially reference 3.

until it is proved that *B. tularense* is unlike other bacteria in this respect, only from immune serum containing adequate protective antibodies would successful treatment be anticipated. The fact that apparently lasting immunity follows the infection in man suggests the feasibility of producing some form of curative serum in experimental animals.

It is our purpose to report results of tests on the protective activity of so-called antitularemic horse serum, and also results of attempts to produce protective serum in sheep and rabbits by methods similar to those used successfully in the production of antipneumococcus and antimeningococcus serums. Modifications were needed because of the toxicity of highly virulent *B. tularense* cultures.

METHODS

Growth and virulence of culture.—It is essential in making potency tests to use only a culture which is of maximum virulence. Such a culture will kill rabbits, guinea pigs, and white mice at the same high point of dilution, irrespective of the enormous differences in weight of the three species. For that reason each test for serum potency is preceded by a control test of the virulence of the experimental culture for the three species. Stock cultures which have been carried in the laboratory solely on culture medium lose some virulence in time and their diminished virulence first shows itself in failure to kill rabbits. Such a culture should be discarded for testing in favor of one of maximum virulence.

The minimal fatal dose for mice of a culture of maximum virulence can be determined with satisfactory constancy by making a series of increasing dilutions of the culture to a point where it will no longer kill. The steps to be followed are: A 24-hour growth of the culture on blood-glucose-cystine agar is prepared. One small loopful of the solid growth is suspended in 1 cc. of saline solution and thoroughly broken up by suction and expulsion in and out through the small opening of a fine capillary pipette. This first suspension will be of varying turbidity and must be diluted by the addition of repeated amounts of 1 cc. of saline solution until it has the standard turbidity of 500, corresponding to 500 parts per million of the silica standard.

In practice the standard turbidity of 500 can be attained quickly with satisfactory accuracy by repeated viewing of the letters of 10 point printer's type in strong diffused daylight through a thin-walled glass agglutination tube of 10 mm. diameter filled with the suspension to be standardized. Too great turbidity will render the letters illegible. Too slight turbidity will render the letters too easily read. A turbidity of 500 will just permit the letters to be made out correctly with difficulty (preferably when the words are spelled backward).

One cc. of a culture of 500 turbidity is the starting point for determining the M. L. D. of a culture (see the first line of each table). Seven cylinders each containing 99 cc. of saline solution and seven sterile pipettes of 1 cc. capacity are the equipment for making the dilutions of 10^{-2} or 0.01 cc., 10^{-4} or 0.0001 cc., 10^{-6} or 0.000001 cc., etc., to 10^{-14}. The dilution 10^{-8} when injected in 0.5 cc. or 1.0 cc. amounts is seen from the tables to constitute the M. L. D. of a fully virulent culture.

Cultures of maximum virulence have been used for immunization in this group of experiments. Slight variations in the technique occurred as noted in each experiment. The culture medium was the same throughout and consisted of the usual blood-glucose-cystine agar in Blake bottles.

Assay of protective titer.—The method was essentially that used for titrating antipneumococcus serum in white mice. Most of the tests were carried out by mixing equal volumes of a standardized virulent culture with immune serum, allowing the mixture to stand at room temperature for 1 hour, and then injecting 1 cc. intraperitoneally. Some tests were run by injecting 0.5 cc. of test culture followed immediately by 0.5 cc. of serum. Eight mice were used for each culture dilution. End points were calculated from the average survival time of the mice.

Serum concentration.—The methods used in concentrating the various serums were those applied to antipneumococcus horse and rabbit serums (*1*, *2*). These included salting out with ammonium sulfate, or sodium sulfate, and also precipitation with alcohol. It is noteworthy that, unlike antipneumococcus serum, agglutinins were associated in great part with the fraction precipitated with 12 to 14 percent of anhydrous sodium sulfate, and 25 to 30 percent of saturation with ammonium sulfate. Contrariwise, in the alcohol method, complete precipitation of agglutinins occurred only after increasing the concentration of alcohol to 30 to 40 percent. Rabbit serums required somewhat higher concentrations of alcohol than sheep serums. In general the results show the possibility of concentrating the agglutinins with apparently no loss. The protein concentration is relatively low so that actually agglutinins could be concentrated at least twentyfold.

ANTITULAREMIC HORSE SERUM

Mulford Biological Laboratories manufacture and sell an antitularemic serum prepared from horses. The serum is marketed in two forms; one form consists of a package of 30 cc. of original liquid horse serum and the other represents a dried lyophilized concentrate of 30 cc. of horse serum. The commercial packages do not contain statements of potency value.

Potency tests of antitularemic horse serums are presented in table 1. Each test in the column headed 10^{-8} shows the average duration of life of mice, in hours, following injection of the minimal lethal dose of the culture of *Bacterium tularense*. The M. L. D. for mice of cultures of maximum virulence is seen to be 0.5 cc. injected intraperitoneally of a dilution of 10^{-8} or 0.00000001 cc. of a culture having a turbidity of 500. The antiserums in 0.5 cc. amounts were either mixed with 0.5 cc. of the M. L. D. of culture for 1 hour before injection, or the injection of culture was followed immediately by the injection of the serum.

The effect of the serum is judged by its ability to save the life of the mice or to increase the interval (number of hours) before death. In the vertical column headed 10^{-8} in table 1 it may be seen that none of the serums prevented death but that all increased the average length of life over that of the culture controls by an excess of time expressed in percentage of the culture control time.

The last item of table 1 is a test of five bleedings of horse No. 2 which was injected with living cultures of maximum virulence in 1924. This horse received 17 subcutaneous injections between April 1, 1924, and November 5, 1924. Five of the bleedings made in 1924 had agglutinin titers at that time of 640, 160, 160, 320, and 160, respectively. The same serums on August 8, 1940, had agglutinin titers, respectively, of 160, 160, 80, 80, and 40. Five sets of mice tested August 8, 1940, against the five 16-year-old serums stored at 5° C. without preservative, all died.

In this test, although no mice lived, with old or new horse immune serum the average increase in life of the animal as compared to the control varied from 28 to 59 percent; with normal horse serum the increase was 11 percent. It may be observed that the agglutinins in old serums were low as compared to those in new serums.

ANTITULAREMIC SHEEP SERUM

A male sheep, 11 months old, which had been stained blue for identification purposes, was subjected to three series of injections during the 13-month period from January 13, 1940, to February 19, 1941, the first series being with living virulent cultures injected subcutaneously, and the second and third series being with formalin-killed cultures injected intravenously. A second sheep, which was white, received only the first and second series of injections.

First series of injections.—Five injections subcutaneously on the abdomen with living virulent cultures of *Bacterium tularense* were given at monthly intervals during the 4-month period from January 13, 1940, to May 17, 1940. The inoculum was freshly prepared for each injection and consisted of a mixture of six platinum loopfuls of solid

TABLE 1.—*Antitularemic horse serum*

(1) Tested July 29, 1939: 1 cc. culture V 25-38-39, turbidity 500, diluted.	10^{-6}	10^{-8}	10^{-10}	10^{-12}.
Control, 6 mice I. P. 0.5 cc. culture.		Average 85 hrs	1 died 5 lived	1 died. 5 lived.
Mulford antitularemic liquid horse serum No. 40540-1, No. 98520. Expiration date Jan. 12, 1940. Tularense agglutination titer 1:640. 6 mice I. P. 0.5 cc. serum was followed immediately by 0.5 cc. I. P. culture 10^{-8}, 10^{-10}, or 10^{-12}.		Average 109 hrs. = 28 percent longer than culture controls.	2 died 4 lived	1 died. 5 lived.
(2) Tested Nov. 29, 1939: 1 cc. culture Pack turbidity 500 diluted.	10^{-6}	10^{-8}	10^{-10}	10^{-12}.
Control rabbit S. C. 1 cc. culture	Dead 5 days	Dead 5 days	1 died 1 lived	Lived.
Control guinea pig S. C. 1 cc. culture.	Dead 5 days	Dead 5 days	1 died 1 lived	Lived.
Control 8 mice I. P. 0.5 cc. culture	Average 69 hrs	Average 91 hrs	1 died 7 lived	
Mulford antitularemic lyophilized dried horse serum No. 40211-1. Expiration date Oct. 24, 1944. Tularense agglutination titer 1:1280 8 mice I. P. 0.5 cc. culture was followed immediately by 0.5 cc. I. P. of dissolved serum.	Average 101 hrs. = 46 percent longer than culture controls.	Average 145 hrs. = 59 percent longer than culture controls.	8 lived	
Same as above except that 4 cc. of dissolved serum was mixed with 4 cc. culture 10^{-6} and after standing 1 hr. R. T. was injected 1 cc. I. P. into each of 8 mice.		Average 144 hrs. = 59 percent longer than culture controls.		
(3) Tested Aug. 8, 1940: 1 cc. culture Pack R. R. B. turbidity 500 diluted.	10^{-6}	10^{-8}	10^{-10}	10^{-12}.
Control rabbit S. C. 1 cc. culture	Dead 11 days	Lived		
Control guinea pig S. C. 1 cc. culture.	Dead 6 days	Lived	Lived	Lived.
Control 8 mice I. P. 0.5 cc. culture.	Average 78 hrs	Average 94 hrs	2 died 6 lived	
Mulford antitularemic lyophilized dried horse serum No. 143085. Expiration date July 1. 1945. Agglutination titer 1:640. 4 cc. dissolved serum+4 cc. culture 10^{-6}. Mixture 1 hr. R. T. 8 mice I. P. 1 cc. of mixture.		Average 149 hrs. = 58 percent longer than culture controls.		
Normal horse serum. 4 cc. serum + 4 cc. culture 10^{-6}. Mixture 1 hr. R. T. 8 mice I. P. 1 cc. of mixture.		Average 100 hrs. = 11 percent longer than culture controls.		
Francis antitularemic horse No. 2 serum, 5 bleedings made in 1924 were tested Aug. 8, 1940. 4 cc. serum +4 cc. culture 10^{-6}. Mixtures 1 hr. R. T. 8 mice I. P. 1 cc. of mixture.	Bled May 6, 1924	Average 131 hrs. = 39 percent longer than culture controls.		
	Bled June 6, 1924	Average 140 hrs. = 49 percent longer than culture controls.		
	Bled July 28, 1924	Average 141 hrs. = 50 percent longer than culture controls.		
	Bled Sept. 26, 1924	Average 140 hrs. = 49 percent longer than culture controls.		
	Bled Nov. 19, 1924	Average 148 hrs. = 57 percent longer than culture controls.		

24-hour growth, one loopful being taken from each of six slants of living cultures, all of maximum virulence—Pack, Hop, A S, M F, Tull, and N J—all isolated between September and December 1939. Each injection of the sheep caused illness of 24 hours' duration, accompanied by elevation of temperature and loss of appetite. The blood

clots of each bleeding were injected into a group of guinea pigs for evidence of bacteremia, but the animals all remained well except in one instance; the blood taken from the blue-stained sheep on April 27, 1940, caused the death of 1 of 6 guinea pigs with typical lesions of tularemia. Preliminary to each monthly injection, tests of the sheep's serums were made for tularense agglutinins and for potency. The five agglutination titers of the blue-stained sheep progressed from 0 to 5120, 2560, 1280, and 1280. Five agglutination titers of the white sheep progressed from 0 to 1280, 320, 160, and 160. Potency tests of the monthly bleedings were made on white mice with the result that, while none showed complete protection, the average survival time was longer than in control mice.

Second series of injections.—Six intravenous injections were given at weekly intervals between July 19, 1940, and August 23, 1940, from a formalinized pool of six cultures made July 16, 1940. The pool had a turbidity of 20,000, i. e., 1 part in 40 parts of saline solution gave a turbidity of 500. The inoculation dose of the concentrated pool varied, increasing from 0.3 cc. on July 19, 1940, to 2.0 cc. on August 23, 1940. The pool was made from 3-day growths on six Blake bottles each of which had been inoculated with one of the above-mentioned six cultures of maximum virulence. The growth was taken off in distilled water containing 0.4 percent formalin.

TABLE 2.—*Antitularemic sheep serums bled Aug. 29, 1940, after second series of injections*

(1) Tested Sept. 23, 1940:			
1 cc. culture Pack R. R. B. turbidity 500 diluted.	10^{-4}	10^{-8}	10^{-10}.
Control rabbit S. C. 1 cc. culture	Lived	Lived	Lived.
Control guinea pig S. C. 1 cc. culture	Dead 7 days	Lived	Lived.
Control 8 mice I. P. 0.5 cc. culture	Average 84 hrs.	Average 117 hrs.	1 died. 7 lived.
Blue sheep bled Aug. 29, 1940. Not concentrated. Tularense agglutination titer 1:5120. 4 cc. serum+4 cc. culture 10^{-6}. Mixture stood 1 hr. R. T. 8 mice I. P. 1 cc. of mixture.		Average 156 hrs.=33 percent longer than culture controls.	
Blue sheep bled Aug. 29, 1940. Concentrated. Tularense agglutination titer 1:2560. 4 cc. concentrated serum+4 cc. culture 10^{-6}. Mixture stood 1 hr. R. T. 8 mice I. P. 1 cc. mixture.		Average 179 hrs.=53 percent longer than culture controls.	
White sheep bled Aug. 29, 1940. Not concentrated. Tularense agglutination titer 1:2560. 4 cc. serum+4 cc. culture 10^{-6}. Mixture stood 1 hr. R. T. 8 mice I. P. 1 cc. mixture.		Average 162 hrs.=38 percent longer than culture controls.	
White sheep bled Aug. 29, 1940. Concentrated. Tularense agglutination titer 1:2560. 4 cc. concentrated serum+4 cc. culture 10^{-6}. Mixture stood 1 hr. R. T. 8 mice I. P. 1 cc. mixture.		Average 175 hrs.=49 percent longer than culture controls.	

Bleedings on August 29, 1940, took 1,000 cc. of blood from the jugular vein of each sheep for potency test. The tularense agglutination titer of the blue-stained sheep was positive 1:5120 and of the white sheep 1:2560. Transcript of one of these potency tests is presented in table 2, in which the column headed 10^{-8} records the average prolongation of life of mice ascribable to the serums, respectively 33 percent and 38 percent in excess of the culture control.

Third series of injections.—Twelve intravenous injections were given to the blue-stained sheep between January 9 and February 19, 1941, from a formalinized pool of nine cultures made December 19, 1940, and which had a turbidity of 7,500, i. e., 1 part in 15 of saline solution gave a turbidity of 500. The pool was made from 3-day growths on nine Blake bottles each of which had been inoculated with one of the above-mentioned six cultures or one of three additional cultures of maximum virulence (Ra, Van, or Beld) which had been isolated from man between August and November 1940. The growth was taken off in 0.4 percent formalin, thrown down in centrifuge, and taken up in 0.4 percent formalin. The following schedule of the third series of injections of the blue-stained sheep consists of four sets of injections spaced 10 days between sets. Each set consists of three daily injections and the dosage for each set is larger than in the preceding set.

Jan. 9, 1941	2.0 cc. of the pool made Dec. 19, 1940.
Jan. 10, 1941	Do.
Jan. 11, 1941	Do.
Jan. 21, 1941	3.0 cc. of the pool made Dec. 19, 1940.
Jan. 22, 1941	Do.
Jan. 23, 1941	Do.
Feb. 3, 1941	6.0 cc. of the pool made Dec. 19, 1940.
Feb. 4, 1941	Do.
Feb. 5, 1941	Do.
Feb. 17, 1941	9.0 cc. of the pool made Dec. 19, 1940.
Feb. 18, 1941	Do.
Feb. 19, 1941	Do.

Bleedings were made from the blue-stained sheep on March 1, 1941, and on May 1, 1941, following the third series of injections. On March 1, 1941, 2,000 cc. taken from the external jugular vein had a tularense agglutination titer of 1:2560 and its potency is recorded in table 3. On May 1, 1941, 1,800 cc. taken from the external jugular vein had a tularense agglutination titer of 1:1280 and its potency against infection in mice is recorded in table 3. It will be noted that concentration of the serum raised its tularense agglutinin titer from 1280 to 10240. As in the preceding tables the significant points of table 3 are seen in the column headed 10^{-8} giving the percentage prolongation of life due to serums as 11 percent and 35 percent with the unconcentrated serum, and 44 percent with the latter serum concentrated.

TABLE 3.—*Antitularemic serum of blue sheep bled after third series of injections*

(1) Bled Mar. 1, 1941, tested Mar. 4, 1941:			
1 cc. culture Broo, turbidity 500 diluted	10^{-6}	10^{-8}	10^{-10}.
Control rabbit S. C. 1 cc. culture		Dead 6 days	Lived.
Control guinea pig S. C. 1 cc. culture	Dead 5 days	Dead 6 days	Lived.
Control 8 mice I. P. 0.5 cc. culture	Average 68 hrs.	Average 82 hrs.	2 died, 6 lived.
Blue sheep bled Mar. 1, 1941. Not concentrated. Tularense agglutination titer 1:2560. 4 cc. serum+4 cc. culture 10^{-8}. Mixture stood 1 hr. R. T. 8 mice I. P. 1 cc. mixture.		Average 91 hrs. = 11 percent longer than culture controls.	
(2) Bled May 1, 1941, tested May 1, 1941:			
1 cc. culture Broo, turbidity 500 diluted	10^{-6}	10^{-8}	10^{-10}.
Control rabbit S. C. 1 cc. culture		Dead 6 days	Lived.
Control guinea pig S. C. 1 cc. culture	Dead 6 days	Dead 6 days	Lived.
Control 8 mice I. P. 0.5 cc. culture	Average 74 hrs.	Average 93 hrs.	2 died, 6 lived.
Blue sheep bled May 1, 1941. Not concentrated. Tularense agglutination titer 1:1280. 4 cc. serum+4 cc. culture 10^{-8}. Mixture stood 1 hr. R. T. 8 mice I. P. 1 cc. mixture.		Average 126 hrs. = 35 percent longer than culture controls.	
(3) Bled May 1, 1941, tested May 16, 1941:			
1 cc. culture Broo, turbidity 500 diluted	10^{-6}	10^{-8}	10^{-10}.
Control rabbit S. C. 1 cc. culture		Dead 8 days	Dead 19 days.
Control guinea pig S. C. 1 cc. culture	Dead 5 days	Dead 8 days	Dead 8 days.
Control 8 mice I. P. 0.5 cc. culture	Average 67 hrs.	Average 79 hrs.	1 died, 7 lived.
Blue sheep bled May 1, 1941. Concentrated 6 times. 4 cc. concentrated serum+4 cc. culture 10^{-8}. Mixture 1 hr. R. T. 8 mice I. P. 1 cc. mixture. (Concentration raised the agglutinin titer from 1280 to 10240.)		Average 114 hrs. = 44 percent longer than culture controls.	

ANTITULAREMIC RABBIT SERUMS

During the 4-month period from January 15, 1940, to May 23, 1940, 20 Belgian hares were given, as a group, three series of intravenous injections with formalinized virulent cultures of *Bacterium tularense*. There were 20 survivors through the first series of injections, 14 through the second series, and 10 through the third series. A bleeding for potency testing was made at the end of each series of injections.

First series of injections.—Twenty rabbits were injected intravenously with formalin-killed cultures on January 15, 20, 25, and 29, 1940. Each inoculum was 2 cc. of 500 turbidity of a pool of 24-hour growth of six cultures of maximum virulence—M F, A S, Tull, Hop, N J, and Pack—which were killed with 0.4 percent of formalin. Fifty cc. of blood was removed from the heart of each rabbit on February 2, 1940, and the individual agglutination titers were 640 in 1 rabbit; 1280 in 7, 2560 in 11, and 5120 in 1. The pooled serum of 400 cc. was tested for potency on white mice in concentrated and unconcentrated form, as shown in table 4, which gives the essential data in the column headed 10^{-8}.

TABLE 4.—*Antitularemic pooled rabbit serums bled Feb. 2, 1940, after first series of injections*

(1) Tested Feb. 8, 1940:				
1 cc. culture Pack R turbidity 500 diluted.	10^{-6}	10^{-8}	10^{-10}	10^{-12}.
Control rabbit S. C. 1 cc	Dead 3 days	Dead 6 days	Dead 7 days	Lived.
Control guinea pig S. C. 1 cc	Dead 5 days	Dead 6 days	Dead 8 days	Do.
Control 8 mice I. P. 0.5 cc. culture.	Average 62 hrs.	Average 91 hrs.	1 died, 7 lived.	
20 rabbits bled Feb. 2, 1940. Not concentrated. Agglutination titer 1:2560. 4 cc. pooled serum+4 cc. culture 10^{-6}, 10^{-8} or 10^{-10}. Mixtures 1 hr. R. T. 8 mice I. P. 1 cc. of mixture.	Average 103 hrs. = 66 percent longer than culture controls.	Average 128 hrs. = 41 percent longer than culture controls.	1 died, 7 lived.	
(2) Tested May 8, 1940:				
1 cc. culture Pack R. R. B. turbidity 500 diluted.	10^{-6}	10^{-8}	10^{-10}	10^{-12}.
Control rabbit S. C. 1 cc		Dead 7 days	Lived	
Control guinea pig S. C. 1 cc	Died 9 days	Dead 6 days	Lived	Lived.
Control 8 mice I. P. 0.5 cc. culture.	Average 66 hrs.	Average 80 hrs.	Lived	
20 rabbits bled Feb. 2, 1940. Concentrated 6 times. Agglutination titer 1:5120. 4 cc. concentrated serum+4 cc. culture 10^{-6}, 10^{-8} or 10^{-12}. Mixtures stood 1 hr. R. T. 8 mice I. P. 1 cc. of each mixture.	Average 99 hrs. = 50 percent longer than culture controls.	Average 115 hrs. = 40 percent longer than culture controls.	1 died, 7 lived.	
Same as above except that each mouse received only 1/16 cc. of concentrated serum instead of 0.5 cc.		Average 125 hrs. = 56 percent longer than culture controls.		
20 rabbits bled Feb. 2, 1940. Not concentrated. Agglutination titer 1:2560. 8 mice received I. P. 1/16 cc. serum+1/2 cc. culture 10^{-6} after mixture stood 1 hr. at R. T.		Average 117 hrs. = 46 percent longer than culture controls.		
(3) Tested May 22, 1940:				
1 cc. culture Pack R. R. B. turbidity 500 diluted.	10^{-6}	10^{-8}	10^{-10}	10^{-12}.
Control rabbit S. C. 1 cc		Dead 6 days	Lived	
Control guinea pig S. C. 1 cc	Dead 5 days	Dead 6 days	Dead 12 days	Lived.
Control 8 mice I. P. 0.5 cc. culture.	Average 70 hrs.	Average 80 hrs.	3 died, 5 lived.	
20 rabbits bled Feb. 2, 1940. Concentrated 6 times. 4 cc. concentrated serum+4 cc. culture 10^{-6}, 10^{-8} or 10^{-10}. Mixtures stood 1 hr. R. T. 8 mice I. P. 1 cc. of each mixture. (In addition, the 10^{-6} group received 1/4 cc. concentrated serum I. P. May 23, 24, 25, and 26.)	Average 85 hrs. = 21 percent longer than culture controls.	Average 112 hrs. = 40 percent longer than culture controls.	1 died, 7 lived.	
20 rabbits bled Feb. 2, 1940. Not concentrated. Agglutination titer 1:2560. 4 cc. pooled serum+4 cc. culture 10^{-6}, 10^{-8} or 10^{-10}. Mixtures stood 1 hr. R. T. 8 mice I. P. 1 cc. of each mixture.	Average 106 hrs. = 51 percent longer than culture controls.	Average 138 hrs. = 72 percent longer than culture controls.	1 died, 7 lived.	

Second series of injections.—Intravenous injections of 14 of the above 20 rabbits with formalin-killed cultures were done on February 15, 19, 27, March 4 and 11, 1940. Each inoculum was the same as in the first series of injections. Five cc. of blood was taken from the

ear of each of the 14 rabbits on March 15, 1940, the individual agglutination titers being 320 in 4 rabbits, 640 in 6, 1280 in 3, and 2560 in 1. The pooled serum had a tularense agglutination titer of 1:1280 and was tested for potency in mice on March 17, 1940, as shown in table 5 (see column headed 10^{-8}).

TABLE 5.—*Antitularemic pooled rabbit serums bled Mar. 15, 1940, after second series of injections*

(1) Tested Mar. 17, 1940:	10^{-6}	10^{-8}	10^{-10}	10^{-12}
1 cc. culture Pack R turbidity 500 diluted.				
Control rabbit S. C. 1 cc. culture.	Dead 5 days	Died 6 days		
Control guinea pig S. C. 1 cc. culture.	Dead 6 days	Dead 7 days	Dead 11 days	Lived.
Control 8 mice I. P. 0.5 cc. culture 10^{-6}, 10^{-8} or 10^{-10}.	Average 103 hrs.	Average 114 hrs.	8 lived	
14 rabbits bled Mar. 15, 1940, after second series. Pooled serum had tularense titer 1:1280. 8 mice I. P. 1 cc. pooled serum was followed immediately by 0.5 cc. culture S. C.	Average 120 hrs.=16 percent longer than culture controls.	Average 190 hrs.=75 percent longer than culture controls.	8 lived	
Normal rabbit serum 8 mice I. P. 1 cc. normal serum was followed immediately by 0.5 cc. culture S. C.	Average 120 hrs.=16 percent longer than culture controls.	Average 158 hrs.=56 percent longer than culture controls.	3 died 5 lived	

TABLE 6.—*Antitularemic rabbit serums bled June 3, 1940, after third series of injections*

(1) Tested June 13, 1940:	10^{-6}	10^{-8}	10^{-10}	10^{-12}
1 cc. culture Pack R. R. B. turbidity 500 diluted.				
Control rabbit S. C. 1 cc. culture.		Died 6 days	Lived	
Control guinea pig S. C. 1 cc. culture.	Dead 6 days	Dead 6 days	Lived	Lived.
Control 8 mice I. P. 0.5 cc. culture 10^{-6}, 10^{-8} or 10^{-10}.	Average 82 hrs.	Average 90 hrs.	2 died 6 lived	
10 rabbits bled June 3, 1940, after third series. Pooled serums not concentrated. Tularense agglutination titer 1:320. 4 cc. serum+4 cc. culture 10^{-6}. Mixture 1 hr. R. T. 8 mice I. P. 1 cc. mixture.		Average 131 hrs.=45 percent longer than culture controls.		
Same as above but Concentrate (A). Agglutination titer 1:640. 8 mice I. P. 1 cc. of mixture.		Average 146 hrs.=62 percent longer than culture controls.		
Same as above but Concentrate (B). Agglutination titer 1:640. 8 mice I. P. 1 cc. of mixture.		Average 140 hrs.=55 percent longer than culture controls.		

Third series of injections.—Fourteen intravenous injections of 10 of the original 20 rabbits with formalinized cultures were made at 4-day intervals between March 25 and May 23, 1940. Each inoculum was the same as in the first series of injections, except that for the last six

injections the amount was increased fivefold to 2 cc. of 2,500 turbidity. The 10 rabbits were bled to death on June 3, 1940, the individual tularense agglutination titers being 640 in 3 rabbits, 320 in 1, and 160 in 6. The pooled serum (400 cc.) had a tularense titer of 1:320 and was tested for potency before and after concentration as reported in table 6.

As shown in tables 4, 5, and 6, after each of the three series of injections, both concentrated and unconcentratedse rums prolonged the life of the experimental animal over that of the control, but no complete protection occurred.

ANTITULAREMIC HUMAN SERUM

Convalescent serum from recovered cases of tularemia has been used for treatment in several severe cases of the disease but it has not proved of value. A test is reported in table 7 in which convalescent serum from patient Pack was tested in mice against culture Pack. Onset of illness in the patient occurred on August 22, 1939. He developed severe lobar pneumonia and *Bacterium tularense* was isolated daily, by guinea pig inoculation, from his sputum from the twenty-sixth to the thirty-eighth days of illness. Blood serum obtained on November 30, 1939, had a tularense agglutination titer of 1:320 and was used for the test reported in table 7. By reading the vertical column 10^{-8} of table 7 it is seen that the serum had no effect on the culture.

TABLE 7.—*Antitularemic human serum*

(1) Tested Dec. 8, 1939:				
1 cc. culture Pack turbidity 500 diluted.	10^{-6}	10^{-8}	10^{-10}	10^{-12}.
Control rabbit S. C. 1 cc. culture.	Dead 6 days	Dead 7 days	Lived	Lived.
Control guinea pig S. C. 1 cc. culture.	Dead 6 days	Dead 6 days	Lived	Lived.
Control 8 mice I. P. 0.5 cc. culture.	8 died	3 died 5 lived	8 lived	
Pack human serum, bled November 30, 1939. Tularense agglutination titer 1:320.		6 died 2 lived		
4 cc. serum+4 cc. culture 10^{-6}. Mixture 1 hr. R. T. 8 mice I. P. 1 cc. of mixture.				
Same as above, except that in 8 mice I. P. 0.5 cc. culture 10^{-6} was followed immediately by 0.5 cc. serum I. P.		8 died		

DISCUSSION AND SUMMARY

It is seen from the above experiments that, by the methods used, protective antibody was not produced in sheep or rabbits against *B. tularense*. A concentration of the serum, at least as measured by

the agglutinin titer, was accomplished without loss as compared to the original serum. However, even with serum thus concentrated life of the average mouse was not prolonged significantly more than with the unconcentrated serum. This same observation was made with different unconcentrated serums, irrespective of variation in agglutinin titer. It is thus seen that protective antibody against *B. tularense* is not necessarily associated with agglutinin titer.

It may be concluded from this study of the antitularemic serums prepared from horses, sheep, and rabbits, and one convalescent human serum, herein reported, that no evidence of protective antibody as measured in white mice was observed. There was a significant increase in the survival time of the mice injected with the serum over that of the control culture mice, but actual survival of the mice inoculated with both serum and 1 to 10 lethal doses of the organism did not occur. The greatest prolongation of life, as expressed in percentages, was 75 percent, and the lowest 11 percent more than the control. However, with one sample each of normal horse and normal rabbit serums, life was prolonged 11 percent and 56 percent, respectively. The human convalescent serum did not protect mice.

REFERENCES

(*1*) Felton, L. D.: Concentration of pneumococcus antibody. J. Infect. Dis., **43:** 543–553 (1928).
(*2*) ————: The use of ethyl alcohol as precipitant in the concentration of antipneumococcus serum. J. Immunol., **21:** 357–373 (1931).
(*3*) Foshay, Lee: Tularemia: A summary of certain aspects of the disease including methods for early diagnosis and the results of serum treatment in 600 patients. Medicine, **19:** 1–83 (1940).

DEATHS DURING WEEK ENDED DECEMBER 27, 1941

[From the Weekly Mortality Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Dec. 27, 1941	Corresponding week, 1940
Data from 87 large cities of the United States:		
Total deaths	8,201	8,553
Average for 3 prior years	8,913	
Total deaths, 52 weeks	430,516	432,027
Deaths per 1,000 population, 52 weeks, annual rate	11.6	11.7
Deaths under 1 year of age	516	509
Average for 3 prior years	485	
Deaths under 1 year of age, 52 weeks	27,161	25,889
Data from industrial insurance companies:		
Policies in force	64,769,523	64,759,998
Number of death claims	9,268	9,893
Death claims per 1,000 policies in force, annual rate	7.5	8.0
Death claims per 1,000 policies, 52 weeks, annual rate	9.3	9.5

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JANUARY 3, 1942

Summary

Slight increases were recorded during the current week for each of the 9 important communicable diseases included in the following table, with the exception of poliomyelitis. The incidence of each of these diseases, however, with the exception of poliomyelitis, was below the 5-year (1936–40) median expectancy.

A total of 3,093 cases of influenza was reported, as compared with 2,587 for the preceding week. The 5-year median for the corresponding week is 3,993, while for the same week last year 77,820 cases were reported. Texas, with 1,319 cases, continued to report the largest number. South Carolina reported 459 cases, Virginia 273, Oklahoma 210, Alabama 134, and Arizona 104. These were the only States reporting more than 100 cases.

A total of 34 cases of tularemia was reported by 14 States. Two cases of anthrax were reported in Pennsylvania. Of 52 cases of endemic typhus fever, 21 cases occurred in Georgia and 9 each in South Carolina and Texas.

The following table shows the total numbers of cases of the 9 communicable diseases as reported weekly by telegraph during 1941. These reports cover a period of 53 weeks, from the week ended January 4, 1941, to the week ended January 3, 1942, inclusive. The median is for corresponding periods of the 5 preceding years (1936–40).

	Diphtheria	Influenza	Measles	Meningitis, meningococcus	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever	Whooping cough
1941	17,310	601,066	874,424	2,072	9,094	130,427	1,393	8,611	211,292
Median	28,586	198,982	315,390	2,884	7,331	190,901	9,648	14,328	174,646

The crude death rate for 88 large cities in the United States for the current week is 12.7 per 1,000 population, as compared with 11.5 for the preceding week and with 12.9 for the corresponding week of January 1941. The cumulative rate for the 53 weeks ended January 3, 1942, is 11.7, the same as for the corresponding period last year.

Telegraphic morbidity reports from State health officers for the week ended January 3, 1942, and comparison with corresponding week of 1941 and 5-year median

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median 1936–40	Week ended—		Median 1936–40	Week ended—		Median 1936–40	Week ended—		Median 1936–40
	Jan. 3, 1942	Jan. 4, 1941		Jan. 3, 1942	Jan. 4, 1941		Jan. 3, 1942	Jan. 4, 1941		Jan. 3, 1942	Jan. 4, 1941	
NEW ENG.												
Maine	2	0	2	1	40	10	174	37	37	0	2	0
New Hampshire	0	0	0	4	-------	-------	18	11	5	0	0	0
Vermont	0	0	0	-------	99	-------	5	24	24	0	0	0
Massachusetts	9	1	5	-------	-------	-------	166	384	354	1	3	2
Rhode Island	3	0	0	-------	-------	-------	28	0	1	0	0	0
Connecticut	0	0	1	2	10	10	53	12	143	1	0	1
MID. ATL.												
New York	19	15	24	[1] 7	[1] 77	[1] 44	253	1,471	294	5	3	5
New Jersey	3	9	13	13	20	20	83	582	278	3	1	1
Pennsylvania	25	16	37	-------	-------	-------	1,010	1,457	75	1	5	2
E. NO. CEN.												
Ohio	21	7	39	13	56	7	90	479	37	0	0	4
Indiana	1	13	21	71	236	46	13	33	11	0	0	1
Illinois [2]	34	25	48	15	34	22	50	975	45	3	0	3
Michigan [3] [4]	10	6	6	2	6	-------	59	693	189	2	1	1
Wisconsin	0	6	2	23	64	62	0	369	359	0	0	0
W. NO. CEN.												
Minnesota	2	0	4	-------	2	1	151	5	21	0	0	0
Iowa	4	18	4	3	43	2	85	132	51	0	0	1
Missouri	3	8	13	5	96	96	18	29	8	1	0	1
North Dakota [2]	7	12	2	2	172	34	31	10	10	1	0	0
South Dakota	2	3	3	-------	-------	6	0	2	2	1	0	0
Nebraska	3	2	2	-------	5	5	11	2	8	0	0	1
Kansas	2	3	10	9	2,453	16	137	112	101	0	0	2
SO. ATL.												
Delaware	2	1	2	-------	-------	-------	7	17	6	0	0	0
Maryland [3]	8	2	4	10	16	16	166	4	11	3	1	1
Dist. of Col	4	1	5	-------	68	2	6	2	3	0	0	1
Virginia	14	13	22	273	1,752	454	121	146	67	4	1	2
West Virginia	5	8	11	10	430	64	270	61	14	1	0	0
North Carolina [4]	29	13	43	26	17	24	427	69	69	0	0	2
South Carolina [4]	12	11	11	459	1,581	909	58	33	13	0	0	1
Georgia [4]	14	5	17	58	788	133	76	8	27	0	1	0
Florida [4]	5	1	10	13	32	4	9	2	11	2	0	3
E. SO. CEN.												
Kentucky	4	4	13	-------	9,601	57	6	191	60	2	1	2
Tennessee [4]	7	4	12	32	613	143	228	25	31	0	2	3
Alabama [4]	12	14	14	134	1,322	377	32	75	46	1	0	3
Mississippi [3]	11	5	7	-------	-------	-------	-------	-------	-------	0	2	1
W. SO. CEN.												
Arkansas	[5] 11	[5] 12	[5] 12	88	6,516	181	76	16	16	5	0	0
Louisiana [4]	8	9	12	6	3,235	23	3	2	3	2	1	1
Oklahoma	8	4	14	210	2,248	222	51	1	3	0	0	1
Texas [4]	48	32	34	1,319	33,283	453	336	50	51	6	2	1
MOUNTAIN												
Montana	0	2	3	3	893	81	41	2	8	1	0	0
Idaho	0	0	1	-------	58	4	11	0	53	0	0	0
Wyoming	0	0	0	8	1,651	21	4	0	4	2	0	0
Colorado	11	3	5	47	1,066	21	401	92	43	0	0	0
New Mexico	0	0	4	-------	220	8	34	55	5	0	0	1
Arizona	2	2	8	104	1,099	138	28	52	6	0	2	1
Utah [3]	1	1	0	7	2,344	7	45	13	48	0	0	0
Nevada [3]	0	-------	-------	-------	250	-------	0	-------	-------	0	-------	-------
PACIFIC												
Washington	0	0	1	3	1,122	-------	22	18	18	0	0	0
Oregon	1	0	0	14	1,172	71	52	29	23	0	0	0
California [4]	20	16	31	99	3,030	78	813	34	43	1	3	3
Total	387	301	639	3,093	77,829	3,993	5,758	7,816	6,670	49	31	60
53 weeks	[5] 17,310	[5] 16,013	[5] 28,586	601,066	420,058	198,982	874,424	283,838	315,390	2,072	1,698	2,884

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended January 3, 1942, and comparison with corresponding week of 1941 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median 1936–40	Week ended—		Median 1936–40	Week ended—		Median 1936–40	Week ended—		Median 1936–40
	Jan. 3, 1942	Jan. 4, 1941		Jan. 3, 1942	Jan. 4, 1941		Jan. 3, 1942	Jan. 4, 1941		Jan. 3, 1942	Jan. 4, 1941	
NEW ENG.												
Maine	0	0	0	22	7	11	0	0	0	1	0	0
New Hampshire	0	0	0	3	3	15	0	0	0	0	0	0
Vermont	1	0	0	12	10	5	0	0	0	0	0	0
Massachusetts	0	0	0	283	120	142	0	0	0	1	1	1
Rhode Island	1	0	0	6	4	6	0	0	0	1	0	0
Connecticut	1	1	0	30	34	51	0	0	0	0	0	0
MID. ATL.												
New York	6	2	1	332	263	361	0	0	0	4	3	4
New Jersey	3	0	0	97	144	130	0	0	0	1	0	1
Pennsylvania	2	0	0	211	258	281	0	0	0	7	10	9
E. NO. CEN.												
Ohio	2	7	2	236	264	380	0	1	6	6	1	4
Indiana	0	2	0	79	103	190	6	0	11	1	1	1
Illinois [2]	3	3	3	172	309	421	0	3	3	2	6	3
Michigan [3 4]	3	0	0	193	156	248	0	8	0	9	1	1
Wisconsin	2	0	0	145	118	181	0	5	5	2	1	1
W. NO. CEN.												
Minnesota	0	1	1	47	47	101	1	5	9	0	5	0
Iowa	0	1	0	40	45	84	1	1	16	0	1	1
Missouri	0	0	0	46	51	148	14	0	11	2	2	2
North Dakota [2]	0	0	0	11	5	28	0	1	8	0	0	0
South Dakota	0	1	0	27	14	29	0	2	5	0	0	0
Nebraska	0	0	0	20	33	38	0	1	1	0	0	0
Kansas	1	0	1	66	67	198	0	0	7	0	0	1
SO. ATL.												
Delaware	0	0	0	21	12	12	0	0	0	0	0	0
Maryland [3]	0	2	0	53	27	54	0	0	0	4	1	2
Dist. of Col.	0	0	0	11	10	11	0	0	0	1	0	0
Virginia	0	3	0	30	46	46	0	0	0	12	1	3
West Virginia	0	2	0	54	48	60	0	0	0	3	3	3
North Carolina [4]	0	0	0	70	50	56	0	0	0	1	1	1
South Carolina [4]	0	0	0	11	17	5	0	0	0	1	0	2
Georgia [4]	1	0	1	36	13	18	0	0	0	6	3	3
Florida [4]	0	3	0	0	3	9	0	0	0	4	0	1
E. SO. CEN.												
Kentucky	0	2	1	89	45	49	0	0	0	2	0	1
Tennessee [4]	2	0	0	49	37	38	0	0	0	3	1	1
Alabama [4]	0	0	0	25	47	19	0	1	0	1	2	2
Mississippi	1	0	0	26	10	13	0	0	0	0	0	2
W. SO. CEN.												
Arkansas	1	0	0	9	11	13	1	0	2	0	1	1
Louisiana [4]	3	0	0	5	5	14	0	0	0	3	12	11
Oklahoma	0	0	0	22	15	28	1	0	8	7	0	4
Texas [4]	0	1	1	48	46	73	1	0	0	3	9	11
MOUNTAIN												
Montana	1	0	0	22	26	37	0	0	4	2	0	1
Idaho	0	0	0	8	5	14	0	0	12	0	0	2
Wyoming	1	0	0	6	1	9	0	0	0	3	0	0
Colorado	0	0	0	25	30	33	0	8	6	0	1	1
New Mexico	0	0	0	5	6	10	0	0	0	0	3	3
Arizona	0	0	0	6	5	5	0	0	0	0	0	2
Utah [3]	0	0	0	26	7	19	0	0	0	0	0	0
Nevada [3]	0	----	----	5	----	----	0	----	----	0	----	----
PACIFIC												
Washington	0	2	1	67	29	39	0	0	5	0	0	1
Oregon	0	2	1	10	11	41	0	0	5	1	2	1
California [4]	3	2	2	105	78	207	0	1	5	4	4	4
Total	38	40	33	2,922	2,695	4,459	25	37	251	98	76	98
53 weeks	9,094	9,810	7,331	130,427	157,711	190,991	1,393	2,502	9,648	8,611	9,662	14,328

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended January 3, 1942, and comparison with corresponding week of 1941—Continued

Division and State	Whooping cough, week ended—	
	Jan. 3, 1942	Jan. 4, 1941
NEW ENG.		
Maine	11	50
New Hampshire	12	5
Vermont	24	15
Massachusetts	110	260
Rhode Island	31	11
Connecticut	47	71
MID. ATL.		
New York	407	375
New Jersey	148	103
Pennsylvania	167	524
E. NO. CEN.		
Ohio	116	245
Indiana	24	19
Illinois [2]	178	145
Michigan [3 4]	461	198
Wisconsin	206	98
W. NO. CEN.		
Minnesota	21	39
Iowa	11	9
Missouri	7	17
North Dakota [2]	9	16
South Dakota	2	1
Nebraska	11	8
Kansas	85	85
SO. ATL.		
Delaware	0	14
Maryland [3]	15	59
Dist. of Col	23	13
Virginia	44	106
West Virginia	37	42
North Carolina [4]	110	192
South Carolina [4]	45	55
SO. ATL.—continued		
Georgia [4]	7	22
Florida [4]	10	6
E. SO. CEN.		
Kentucky	46	22
Tennessee [4]	17	17
Alabama [4]	3	18
Mississippi [3]	----	----
W. SO. CEN.		
Arkansas	4	10
Louisiana [4]	0	4
Oklahoma	7	26
Texas [4]	64	232
MOUNTAIN		
Montana	14	13
Idaho	3	3
Wyoming	5	8
Colorado	13	23
New Mexico	9	15
Arizona	9	20
Utah [3]	47	32
Nevada [3]	0	----
PACIFIC		
Washington	78	43
Oregon	23	6
California [4]	111	154
Total	2,832	3,449
53 weeks	211,292	174,448

[1] New York City only.
[2] Rocky Mountain spotted fever, week ended Jan. 3, 1942, 2 cases, as follows: Illinois, 1; North Dakota, 1.
[3] Period ended earlier than Saturday.
[4] Typhus fever, week ended Jan. 3, 1942, 52 cases, as follows: Michigan, 2; North Carolina, 2; South Carolina, 9; Georgia, 21; Florida, 2; Tennessee, 1; Alabama, 2; Louisiana, 3; Texas, 9; California, 1.
[5] Corrected report from Arkansas for the week ended Dec. 27, 1941, shows 12 cases of diphtheria, 81 cases of influenza, and 49 cases of measles, instead of the respective reports of 11, 98, and 26 cases as shown in PUBLIC HEALTH REPORTS of Jan. 2, p. 23.

WEEKLY REPORTS FROM CITIES

City reports for week ended December 20, 1941

This table lists the reports from 102 cities of more than 10,000 population distributed throughout the United States, and represents a cross section of the current urban incidence of the diseases included in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Maine:											
Portland	0	------	0	2	4	8	0	1	0	3	29
New Hampshire:											
Concord	0	------	0	0	0	1	0	0	0	0	10
Manchester	0	------	0	5	0	33	0	0	0	0	13
Nashua	0	------	0	0	1	2	0	0	1	7	12
Vermont:											
Barre	0	------	0	0	0	0	0	0	0	0	--------
Burlington	0	------	0	0	0	0	0	0	0	0	9
Rutland	0	------	0	0	0	0	0	0	0	0	--------
Massachusetts:											
Boston	1	------	0	29	9	39	0	9	0	32	194
Fall River	3	------	0	3	0	41	0	0	0	1	28
Springfield	0	------	0	9	1	13	0	0	0	14	30
Worcester	0	------	0	13	4	17	0	0	0	13	50
Rhode Island:											
Providence	1	1	0	7	2	3	0	2	1	48	57
Connecticut:											
Bridgeport	0	------	0	7	1	2	0	------	0	3	--------
Hartford	0	------	0	0	0	1	0	------	0	0	--------
New Haven	0	------	0	35	2	1	0	1	0	1	44
New York:											
Buffalo	0	------	0	1	2	14	0	4	1	17	135
New York	20	6	5	13	76	155	0	76	1	249	1,523
Syracuse	0	------	0	0	1	2	0	0	0	27	45
New Jersey:											
Newark	0	4	1	27	4	12	0	4	0	37	100
Pennsylvania:											
Pittsburgh	2	------	1	2	8	22	0	3	0	15	158
Reading	0	------	0	2	0	2	0	------	0	1	21
Scranton	0	------	--------	7	--------	2	0	------	0	1	--------
Ohio:											
Cincinnati	0	------	0	1	3	10	0	6	0	9	130
Cleveland	0	7	2	1	10	51	0	7	0	22	196
Columbus	1	2	2	2	2	5	0	0	0	11	81
Toledo	0	------	0	1	6	7	0	1	0	13	71
Indiana:											
Fort Wayne	0	------	0	0	3	1	0	0	0	0	25
Indianapolis	2	------	0	0	10	25	0	3	0	5	101
Muncie	0	------	0	0	3	0	1	0	0	0	11
South Bend	0	------	0	0	0	2	0	0	0	0	19
Terre Haute	0	------	0	1	2	1	0	0	0	0	14
Illinois:											
Alton	0	------	0	0	0	0	0	1	0	3	11
Chicago	20	5	5	8	18	89	0	27	0	102	717
Moline	0	------	--------	1	--------	0	0	------	0	7	13
Michigan:											
Detroit	5	2	1	12	10	75	0	8	0	30	269
Flint	0	------	0	2	4	0	0	0	0	5	33
Grand Rapids	0	------	0	4	2	4	0	0	0	0	33
Wisconsin:											
Madison	0	------	--------	3	--------	2	0	------	0	3	14
Milwaukee	0	------	0	1	3	42	0	2	0	115	102
Minnesota:											
Duluth	0	------	0	0	1	8	0	1	0	0	29
St. Paul	0	------	0	24	2	4	0	2	0	28	66
Iowa:											
Cedar Rapids	0	------	--------	0	--------	1	0	------	1	0	--------
Davenport	0	------	--------	0	--------	7	0	------	0	0	--------
Des Moines	0	------	--------	1	--------	1	0	------	0	0	31
Sioux City	0	------	--------	0	--------	0	0	------	0	0	--------
Waterloo	1	------	--------	0	--------	2	0	------	0	0	--------
Missouri:											
Kansas City	0	------	4	6	2	12	0	1	0	0	108
St. Louis	2	1	0	2	7	10	0	5	0	8	190
North Dakota:											
Fargo	0	------	0	0	0	0	0	0	0	0	12
Grand Forks	0	------	--------	0	--------	0	0	------	0	0	--------

City reports for week ended December 20, 1941

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
South Dakota:											
Aberdeen	0	------	-------	0	------	5	0	------	0	0	-------
Sioux Falls	0	------	-------	0	------	0	0	------	0	0	9
Nebraska:											
Lincoln	0	------	-------	0	------	0	0	------	0	0	-------
Omaha	0	------	0	1	1	4	0	1	0	0	72
Kansas:											
Lawrence	0	4	0	1	1	0	0	0	0	0	3
Wichita	0	2	0	24	7	8	0	------	0	1	-------
Dist. of Col.:											
Washington	0	------	-------	5	11	22	0	------	1	16	-------
Virginia:											
Norfolk	1	------	0	0	3	1	0	------	0	1	37
Richmond	0	------	0	0	3	0	0	0	0	0	56
Roanoke	0	------	0	1	0	0	0	0	0	0	11
West Virginia:											
Charleston	0	------	0	0	1	0	0	0	0	0	20
North Carolina:											
Raleigh	0	------	0	0	0	1	0	1	0	1	9
Wilmington	0	------	0	30	0	0	0	0	0	4	13
South Carolina:											
Florence	0	------	0	0	0	0	0	1	0	0	6
Georgia:											
Atlanta	1	6	1	4	4	4	0	------	0	0	-------
Brunswick	0	------	0	0	1	0	0	1	0	0	4
Savannah	0	------	1	17	0	0	0	1	0	0	31
Florida:											
St. Petersburg	0	------	-------	1	------	1	0	------	0	0	25
Tampa	1	------	0	0	1	2	0	0	1	0	28
Kentucky:											
Covington	0	------	0	0	3	2	0	3	0	0	22
Louisville	0	------	0	4	5	20	0	4	0	31	68
Tennessee:											
Knoxville	0	------	0	9	0	1	0	0	0	0	33
Memphis	0	4	2	2	2	10	0	1	0	9	77
Alabama:											
Mobile	0	------	2	3	2	0	0	1	0	0	38
Montgomery	0	------	-------	0	------	0	0	------	0	0	-------
Arkansas:											
Little Rock	0	8	0	0	2	1	0	0	0	0	12
Louisiana:											
Lake Charles	0	------	-------	0	------	0	0	------	0	0	5
New Orleans	2	1	1	1	13	4	0	7	0	2	139
Oklahoma:											
Oklahoma City	2	3	0	0	3	2	0	1	0	0	61
Tulsa	7	------	0	174	6	3	0	0	0	0	28
Texas:											
Dallas	3	2	2	24	7	4	0	0	0	3	66
Fort Worth	1	------	0	0	3	1	0	1	0	0	43
Houston	4	------	0	1	7	0	0	4	1	0	112
San Antonio	1	20	3	2	5	0	0	4	0	3	70
Montana:											
Billings	0	------	0	0	1	2	0	0	0	0	7
Helena	0	------	0	0	0	0	0	0	0	2	2
Missoula	0	------	0	0	0	0	0	0	0	0	3
Idaho:											
Boise	0	------	0	0	1	0	0	1	0	0	10
Colorado:											
Colorado Springs	0	------	0	2	0	0	0	0	0	2	13
Denver	14	26	0	29	9	1	0	2	0	16	92
Pueblo	0	------	0	201	4	4	0	0	0	1	15
New Mexico:											
Albuquerque	0	------	0	0	0	0	0	1	0	0	10
Arizona:											
Phoenix	0	46	-------	5	------	0	0	------	0	1	-------
Utah:											
Salt Lake City	0	------	0	3	0	3	0	1	0	2	35
Washington:											
Seattle	0	------	0	0	3	1	0	3	2	31	97
Spokane	0	------	0	0	2	6	0	1	0	1	33
Tacoma	0	------	0	0	3	5	1	1	0	5	86

City reports for week ended December 20, 1941—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Oregon:											
Portland	0	2	0	1	5	0	0	3	0	3	77
Salem	0			1		0	0		0	0	
California:											
Los Angeles	3	14	1	17	5	27	0	18	1	13	377
Sacramento	2	1	1	20	5	1	0	4	0	1	39
San Francisco	0	2	0	5	7	3	0	6	0	4	175

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Maine:				South Dakota:			
Portland	0	0	1	Aberdeen	0	0	1
New York:				District of Columbia:			
New York	3	0	1	Washington	1	0	0
New Jersey:				Tennessee:			
Newark	1	0	0	Memphis	0	1	0
Ohio:				Montana:			
Cleveland	0	0	1	Helena	0	0	1
Michigan:				California:			
Detroit	1	0	0	Los Angeles	0	0	1
Iowa:							
Waterloo	0	0	1				

Encephalitis, epidemic or lethargic.—Cases: New York, 2. Deaths: New York, 5.
Pellagra.—Cases: Savannah, 1; Montgomery, 1; San Antonio, 1.
Typhus fever.—Cases: New York, 1; Atlanta, 1; Savannah, 4; Montgomery, 8; New Orleans, 1; Los Angeles, 1.

Rates (annual basis) per 100,000 population for a group of 66 selected cities (population, 1940, 28,660,496)

Period	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Typhoid fever cases	Whooping cough cases
		Cases	Deaths						
Week ended Dec. 20, 1941	16.01	19.65	6.37	109.89	54.40	142.82	0.18	1.64	165.74
Average for week, 1936–40	22.83	270.43	11.60	247.97	101.62	171.76	2.58	3.31	160.16

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended December 6, 1941.—During the week ended December 6, 1941, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		4		2	7	1	2	1		17
Chickenpox		26		379	728	62	93	26	153	1,467
Diphtheria		17	3	24		5	5		1	55
Dysentery				8					1	9
Influenza		15			70	1	8		25	119
Measles		1		402	91	13	58	3	24	592
Mumps		2		461	227	41	49	28	96	904
Pneumonia		10			6	2	1		8	27
Poliomyelitis			1	1	1		1			4
Scarlet fever	1	39	5	146	265	7	29	22	27	541
Tuberculosis	4	8	10	79	41	45	6	1		194
Typhoid and paratyphoid fever		1	1	11	12		4			29
Whooping cough		9	1	153	143	2	7		18	333

GREAT BRITAIN

England and Wales—Infectious diseases—13 weeks ended June 28, 1941.—During the 13 weeks ended June 28, 1941, cases of certain infectious diseases were reported in England and Wales as follows:

Disease	Cases	Disease	Cases
Diphtheria	11,650	Puerperal pyrexia	1,644
Dysentery	1,443	Scarlet fever	13,531
Ophthalmia neonatorum	1,045	Typhoid and paratyphoid fever	920
Pneumonia	12,800		

England and Wales—Vital statistics—Second quarter 1941.—The following vital statistics for the second quarter of 1941 for England and Wales are taken from the Quarterly Return of Births, Deaths, and Marriages, issued by the Registrar-General and are provisional:

	Number	Annual rate per 1,000 population		Number	Annual rate per 1,000 population
Live births	147,246	14.2[1]	Deaths under 1 year of age	8,712	[1] 59
Stillbirths	5,474	0.53	Deaths from diarrhea (under 2 years of age)	665	[1] 4.5
Deaths, all causes	139,891	13.5			

[1] Per 1,000 live births.

NOTE.—All deaths are of civilians only.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—Except in cases of unusual prevalence, only those places are included which had not previously reported any of the above-mentioned diseases, except yellow fever, during the current year. All reports of yellow fever are published currently.

A cumulative table showing the reported prevalence of these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday of each month.

Smallpox

Morocco—Casablanca.—An epidemic of smallpox was reported to have broken out in the region of Casablanca, Morocco, during the last 2 weeks of December, according to information dated December 31, 1941. Official figures are not available, but known cases among the natives were stated to be occurring at the rate of about 100 a week, and 47 cases had occurred in Europeans. The report stated that the population was being vaccinated.

Typhus Fever

Morocco—Casablanca.—Information dated December 31, 1941, reports both typhus fever and typhoid fever present in Casablanca, Morocco, in epidemic form.

Yellow Fever

Brazil—Amazonas State—Porto Velho.—On October 1, 1941, 1 death from yellow fever was reported in Porto Velho, Amazonas State, Brazil.

Colombia—Intendencia of Meta—San Martin.—On November 26, 1941, 1 death from yellow fever was reported in San Martin, Intendencia of Meta, Colombia.

Dahomey—Grand Popo.—On December 15, 1941, 2 suspected cases of yellow fever were reported in Grand Popo, Dahomey.

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